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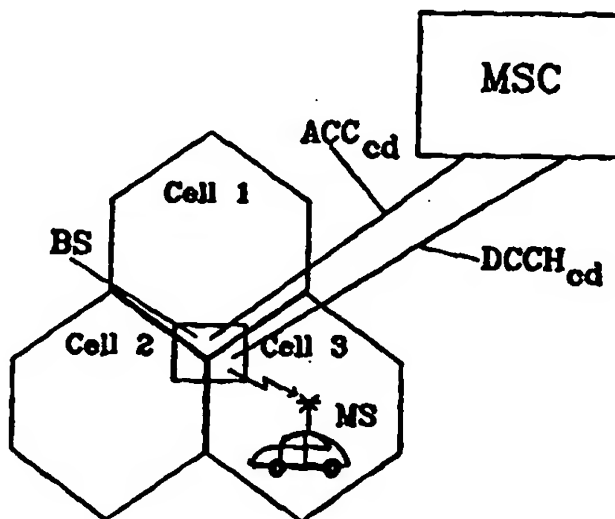
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## (57) Abstract

The present invention relates to an arrangement and a method respectively for communication of control data or multiuser signals between an exchange (MSC) and a number of radio base stations in a communication system wherein each base station (BS) is connected to the exchange (MSC) via a connecting arrangement comprising a number of control channels. At least the part of the connecting arrangement connecting to the base station (BS) comprises one digital and/or one analog control channel ( $ACC_{cd}$ ,  $DCCH_{cd}$ ) which is dedicated for multiuser signals and multiuser signals from the exchange (MSC) to a radio base station (BS) are sent only on the dedicated control channel(s). The radio base station (BS) comprises a receiving arrangement wherein is checked if an incident signal is a multiuser signal. If it is established that it is a multiuser signal, it is distributed to at least a number of the other control channels of that particular base station.



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SYSTEM AND METHOD FOR LOAD REDUCTION IN A MOBILE COMMUNICATION  
SYSTEM AND A MOBILE COMMUNICATION SYSTEM.

5

TECHNICAL FIELD

The present invention relates to a system for connection or  
communication between an exchange and a number of radio base  
10 stations in a communication system. To an exchange a number of  
radio base stations are arranged which are connected to the  
exchange via a connecting arrangement which comprises a number  
of control channels on which control data are communicated. The  
invention furthermore relates to a method for communicating  
15 control data between an exchange and a number of radio base  
stations of the communication system on a connecting arrangement  
for providing the communication which arrangement comprises a  
number of control channels.

The invention also relates to a base station receiving control  
20 data from an exchange. Still further the invention relates to a  
cellular communication system comprising at least one exchange  
and a number of radio base stations as well as a number of mobile  
stations wherein the exchange is connected to the base stations  
via a connecting arrangement which comprises a number of control  
25 channels.

STATE OF THE ART

Today systems exist which comprise a number of exchanges to each  
of which a number of base stations are connected. For example  
30 according to the EIA/TIA-standards (Electronic Industries  
Association/Telecommunications Industries Association) the base  
stations are connected to the exchange via pulse code modulation  
links also named PCM-links. One time slot of a PCM-link is  
dedicated for control purposes. In a mobile communication system  
35 the coverage of a base station is generally divided into either  
one cell, for example a so called omni- directional cell or into  
three cells called sector cells each covering a given number of

degrees. For each cell there is at least one control channel; there can be one digital control channel or one analog control channel but there can also be both a digital and an analog control channel per cell. The time slot of the PCM-link used for control purposes can at most be shared by three analog and three digital control channels in the known system. In case of a call to a mobile station a so called page signal which is a control message which contains the mobile station identity is broadcasted. In order to find the wanted mobile station the page signal has to be broadcasted over a wide geographic area and it is sent to the base stations through all the control channels.

In a cellular system comprising sector cells the same page signal is sent through all three (in case of just one control channel per cell) or through all six (in case of a digital and an analog control channel per cell) from one and the same exchange to the same base station. If it is not known whether the mobile station is an analog station or a digital station, the page signal has to be sent over the analog as well as over the digital control channels. Just one single call to a mobile station thus gives rise to a large number of page signals over the whole location area or the paging area. Presently most of the signals on the downlink control channels, i.e. from the exchange in a direction towards mobile stations are page signals leaving little room for other signals since the capacity of the single time slot dedicated for control signals is limited. In a particular case the bit-rate on the PCM-link comprises 64 kbit/s. The result is that a bottleneck is formed between the exchange, for example a mobile switching center MSC and the base station. Therefore the time slot of the PCM-link used for control purposes will be saturated before any other part of the MBS subsystem in the case of a high number of page signals. Thus there is a risk that the system gets saturated in case of heavy traffic.

In for example the GSM-system paging is performed slightly differently. One signal is sent from the exchange or the mobile switching center MSC to the base station controller BSC and from

the base station controller BSC one page signal per control channel is sent to the base station (or base transceiver station) in the same manner as explained above. Thus it is the connection between a base station controller and the base station which runs the risk of being overloaded or congested for example in case of a heavy traffic case.

#### SUMMARY OF THE INVENTION

It is an object of the present invention to provide an arrangement for communication of control data or multiuser signals between an exchange and a number of radio base stations wherein the exchange is connected to the base station means via a connecting arrangement which comprises a number of control channels in which the load on the connecting arrangement is reduced. It is thus an object of the invention to reduce the number of signals having to be sent for one single connection which are common and identical for all the control channels of a base station which signals here are referred to as multiuser signals. User in this context refers to transceivers as users of the signal. It is also an object of the present invention to reduce the load on the receiving arrangement, e.g. a processing system in the radio base station. Particularly the invention intends to provide a system for paging, i.e. defining the location of a mobile subscriber or a mobile station which system is efficient and which does not unnecessarily produce a high load on the link or the connecting arrangement between the exchange, particularly a telephone exchange, and the base station, an exchange here taken to mean also a base station controlling means, a base station controller BSC.

It is also an object to provide a connecting arrangement between an exchange and a radio base station which has a high capacity.

Another object of the present invention is to provide a method for communicating multiuser signals (control data) such as e.g. page signals or short message service signals between an exchange and a number of radio base stations with a reduced risk of

overloading the connecting arrangement in case of many simultaneous actions. It is also an object to provide a method which reduces the load on the receiving arrangement of the radio base station.

5

Still a further object of the invention is to provide a communication system comprising a number of exchanges, a number of radio base stations and a number of mobile stations wherein the communication of multiuser signals such as paging signals or  
10 short message service signals etc. can be carried out in an efficient manner with a reduced risk of overloading or congestion of a connecting arrangement connecting radio base stations with an exchange and wherein the load on the receiving arrangements is reduced.

15

The invention also has as an object to provide a radio base station which enables and fulfils the above mentioned objects.

These as well as other objects are achieved through a system and  
20 a method respectively for communication of control data between an exchange and a number of radio base stations wherein the connecting arrangement which comprises a number of control channels is provided with one digital and/or one analog control channel which is dedicated for multiuser signals. The radio base  
25 station comprises a receiving arrangement which checks if an incident signal is a multiuser signal, and if it is a multiuser signal, it distributes said multiuser signal to at least a number of the control channels of that particular base station. Particularly the multiuser signals comprise page signals.  
30 According to particular embodiments they may also comprise so called short message service signals or other similar signals. Advantageously multiuser signals are only sent on the dedicated control channel and on no other channel. However, also other signals may be sent on this control channel.

35

The invention also provides for a communication system through which the load on the connecting arrangement which comprises a

number of control channels and which connects an exchange with a radio base station through dedicating either one digital control channel or one analog control channel or one of each of an analog and a digital control channel for multiuser signals of a given kind such as e.g. page signals, short message service signals or similar.

Yet further the invention provides a radio base station communicating with an exchange which provides control data wherein the base station comprises processing means for checking if a control signal coming in on a control channel dedicated for control purposes is a multiuser signal and if it is, distributing the multiuser signal to other control channels corresponding to the same cell as the control channel dedicated for multiuser signals.

Through the invention the number of multiuser signals which have to be sent in order to find the appropriate base station or the wanted mobile station is considerably reduced in that one and the same signal does not have to be sent on more than one or two (e.g. in case it is not known if the mobile station is an analog station or a digital station it may be sent on two) control channels from one and the same exchange to the base station or in the case of e.g. the GSM-system, from the base station controller to the base (transceiver) station. Thus the number of multiuser signals such as page signals which have to be distributed or broadcasted is considerably reduced as compared to known arrangement or systems. Another advantage of the invention is that the reduced load on the control channels by multiuser signals will free capacity in the control channels for other traffic events and that it also prevents or limits the risk of a bottleneck being produced both on the connection to the base station and in the receiving processor.

#### BRIEF DESCRIPTION OF THE DRAWINGS

The invention will in the following be further described in a non-limiting way under reference to the accompanying drawings in



which:

- Fig 1.        schematically illustrates the distribution of multiuser  
              signals to a number of base stations,
- 5            Fig 2.        schematically illustrates communication between an  
              exchange, a base station with three cells and a mobile  
              station,
- 10          Fig 3a.     illustrates a base station with a multichannel unit  
              communicating with a mobile switching center MSC and  
              a mobile station,
- Fig 3b.     illustrates one separate channel unit of the  
15            multichannel unit of Fig. 3a,
- Fig 4.        illustrates an example of the content of a data signal,
- Fig 5.        schematically illustrates a base station modified  
20            according to the invention,
- Fig 6.        illustrates a comparison between the load on the  
              connecting arrangement of a known system and a system  
              according to the invention and
- 25            Fig 7.        illustrates an embodiment relating to the GSM-system.

#### DETAILED DESCRIPTION OF THE INVENTION

- 30          The invention relates to mobile communication systems in general  
              and in the following embodiment the invention will be described  
              in relation to a cellular communication system.

              The mobile communication system generally comprises a number of  
35          mobiles switching centers MSC, home location registers, base  
              stations BS and mobile stations MS. It is the mobile switching  
              center MSC that forms an interface with e.g. the public switched

telephone network. A number of base stations BS are connected to a mobile switching center MSC via digital and/or analog lines. Areas covered by one specific base station BS are called cells. Thus a base station may serve more than one cell i.e. a cell  
5 relates to a geographic area wherein a call can be effected with use of one and the same radio channel. The cells which are connected to a particular mobile switching center MSC are said to form a so called MSC area.

10 Now a particular kind of multiuser signals, namely page signals will be discussed. The functioning of the invention is the same for other multiuser signals. If a mobile station is allowed to move freely within an MSC-area without notifying the exchange about its exact location, the exchange MSC has to send page  
15 signals in parallel to all base station, or the mobile station is paged parallelly from all the cells in the area. In some systems so called location areas are introduced which form areas within one MSC area. Then paging will be done in parallel from all cells within the location area instead which reduces the load  
20 on the paging channel. The base stations BS comprise channel units each comprising radio transmitter, radio receiver and control unit. The control unit is used for data communication with the mobile switching center MSC and for data signalling with a mobile station MS on the radio path. The mobile stations MS  
25 comprise a radio transmitter, radio receiver and logic unit for data signalling for the base station BS and a telephone part.

As referred to above a base station BS can communicate with the mobile stations MS which are within a given area close to the  
30 base station BS. The cells i.e. the areas which are covered by one base station can be of different types, for example omni-directional cells or sector-cells generally depending on the kind of antennas which are used. An omni-directional cell generally comprises one omni-directional antenna whereas in the case of  
35 sector cells e.g. three directional antennas may be provided each covering one cell. Thus, using sector cells, the base station BS serves three cells. In the described system, a mobile station

MS moves freely within the service area of the mobile switching center MSC or, in further particular embodiments, the service area is divided into a number of location areas. In the case of an undivided MSC service area the mobile station can move freely within that area without informing the exchange MSC about its location and thus the exchange MSC does not know the exact location of the mobile station as referred to in the foregoing. In case the service area is divided into location areas, the mobile station informs the mobile switching center MSC when it moves from one location area to another which is also known as location area registration. A call to a mobile subscriber must in the first case be sent via all cells in the service area of the mobile switching center MSC. If a location area division is applied, paging of the mobile station is performed by all cells of that particular location area.

As will be further discussed later on, each cell comprises at least one control channel, generally one analog or one digital or both an analog and a digital control channel. According to the invention one of the control channels is dedicated for multiuser signals if there are either digital or analog control channels. According to one embodiment of the invention, one control channel is dedicated for multiuser signals which can be either digital or analog also when both digital and analog control channels are present. This requires a communication function between digital and analog control channels, i.e. a connection between the software relating to the respective control channels. More particularly it is also possible to use the one having the lowest load in which case load controlling means may be used. If there are both digital and analog control channels, one analog and one digital control channel may in an advantageous embodiment as referred to in the foregoing be dedicated for multiuser signals.

The invention relates to substantially all signals which are common and identical for all (e.g. 3 or 6 but there can of course also be other numbers) control channels. In this application those signals are generally referred to as multiuser signals. In

the particularly described embodiments are referred to page signals but of course the invention likewise applies to other multiuser signals as referred to above. In this context (multi)user means transceivers as users of the signal.

5

In Fig 1 is very schematically illustrated an example of a distribution of page signals here merely indicated through the lines to the base stations for illustrative purposes from one exchange MSC to a number of base stations BS for one call to a mobile station. In today known systems every link or connecting arrangement must forward up to 6 identical page signals every time; generally 3,6 refers to the case when it is not known whether the mobile station is analog or digital as discussed to above.

15

In a particular embodiment of the invention each cell comprises one control channel. Thus, if the base station BS serves three sector cells (see fig 2), it is equipped with three channel units. The control channels are used only for control data.

20

In fig 2 is shown a mobile switching center MSC, a base station BS covering three cells (sector cells) 1,2,3, and a mobile station MS. Multiuser signals are sent to the base station BS from the mobile switching center MSC, in this case page signals, on one dedicated analog control channel and one dedicated digital control channel  $ACC_{cd}$  and  $DCCH_{cd}$  respectively. In the shown embodiment there is one dedicated control channel of each kind, analog and digital, but it could also be only an analog control channel or only a digital control channel, for example depending on if it is an analog or a digital station. Fig 3a schematically illustrates the communication between the mobile switching center MSC, the base station BS and a mobile station MS. Since the base station BS serves three sector cells there are three channel units CHU'. In Fig 3a there is illustrated a multi channel-unit CHU which in this particular embodiment comprises three channel units CHU' as illustrated in Fig 3b. Each channel unit CHU' comprises a control unit CU, a transmitter TX and a receiver RX.

As referred to above a number of base stations BS are connected to one exchange MSC via pulse code modulation links PCM links. The PCM link here merely comprises one single time slot TS being used for control purposes and this single time slot TS can at most be shared by three analog and three digital control channels ACC, DCCH. These limitations relating to the PCM-link are relevant in the present context.

When there is a call to a mobile station MS a page signal is broadcasted to a number of base stations BS in order to find the one covering the relevant mobile station MS. The page signals are sent to the base stations BS through the dedicated control channels  $ACC_{cd}$  and/or  $DCCH_{cd}$ . As referred to above, also if there are both analog and digital control channels according to a particular embodiment, the multiuser signals may be sent only on either the digital control channel or the analog control channel. If the type of the mobile station is known, the page signal is just sent on either the analog or the digital control channel. In this case page signals (or any other multiuser signals) are only sent on the one (or maximum two if it is not known if the mobile station is analog or digital according to a particular embodiment as referred to in the foregoing) dedicated control channel to each base station.

The multi-user-signal to the base station BS comprises a number of data fields as illustrated in Fig 4.

In the shown embodiment it is the first receiving arrangement of the base station BS which e.g. may be an operating system or an application, that examines the signal frame. I.e. a receiving processor unit reads the data signal, the type field indicates if it is a multiuser signal or even more particularly even a page signal as exemplified in Fig. 4. The first receiving arrangement of the base station distributes a signal to a number of or all (e.g. the other two or four, of analog and/or digital) control channels or cells. This is also very schematically indicated in Fig 5. Here PCM-links comprising 24 time slots  $TS; TS_e, TS_{e1}$  are

received in a base station BS. The time slots  $TS_c$ ;  $TS_{c1}$  represent the time slot used for control purposes. The other time slots  $TS$  may comprise speech etc. The time slots  $TS_{c1}$  are also for control purposes but do not comprise multiuser signals. (The number of  
5 time slots, control slot for control purposes can of course be different in different systems to which the present invention naturally also relates).

The receiving process in the Extended Module Regional Processor  
10 EMRP of the base station has to read the content of a number of data fields in order to decide which action is to be taken with the data information comprised in a received signal packet. A possible content as already mentioned above is among other some indication of the type of the signal, e.g. a page signal, or the  
15 type of signal to be distributed to some of or all the control program processes, i.e. the control channels. If it is not deemed necessary to provide the multiuser signal to all the other control channels, e.g. in case of non-relevance or similar it is only distributed to the other(s). According to one advantageous  
20 embodiment every control channel comprises one executing processor but there may also be one common processor for all control channels or some of them. In the following the receiving program process will be briefly explained. A signal or a control signal enters the base station BS wherein an Exchange Terminal  
25 Board ETB extracts the time slots  $TS_c$ ;  $TS_{c1}$  dedicated for control purposes. The time slots  $TS$  dedicated for speech are forwarded to the transceivers TRX via the time switch TSW over a speech data bus. This is not expressively indicated in Figure 5; that is so for reasons of clarity and since it is not relevant for the  
30 present invention. The addresses of the control time slots  $TS_{c1}$ ,  $TSC_1$  are read in the Signalling Terminal Regional STR, i.e. it is settled to which Extended Module Regional Processor  $EMRP_x$ ;  $EMRP_{cw}$  they are to be forwarded. Here the time slots  $TS_c$  for control purposes relating to multiusers signals are transferred to the  
35 multiuser Extended Module Regional Processors  $EMRP_{cw}$  whereas other time slots  $TS_c$  for control purposes (thus not relating to multiuser signals) are either transferred to the same processor

(not shown in Figure 5 for reasons of clarity) or to EMRP<sub>i</sub>. In reality there may of course be more than one further processor dealing with non-multiuser signals or they may generally all be handled by the EMRP<sub>cm</sub>, etc.; this is however irrelevant for the present invention.

According to one advantageous embodiment of the invention it is thus the first receiving software of the base station (in the EMRP<sub>cm</sub>) that distributes a multiuser signal to the other two control channel software processes after having settled from the header of the signal that it is a multi-user signal. The extension module examines the signal field and the signal is forwarded to the final destination which will be in the transceivers TRX. In the shown embodiment every cell has at least one transceiver which is dedicated for handling the functions of the control channel. If thus a page signal (or another multiuser signal) is transferred only on one control channel the extension module regional processor EMRP<sub>cm</sub> checks the field "types" and if it is e.g. a page signal, the signal is distributed to the other two control channel processors which hence is done by the first receiving unit EMRP<sub>cm</sub> which comprises hardware as well as software. Thereafter each page signal is sent by the three control channel processors to the transceivers of the respective process.

In Fig. 5 the speech slots TS reaches the transceivers TRX via multiplexing interfaces MI which however not are necessary for the functioning of the present invention but merely relate to one specific embodiment including such. This is however not necessary.

Fig 6 briefly illustrates the load on the connecting arrangement or the PCM link which is caused by four page signals on three control channels as in hitherto known systems as compared to a system according to the invention wherein the link is loaded by four paging signals on just one control channel. All the boxes, filled plus non-filled represent the load of the prior art system

whereas the filled boxes represent a load by the system according to the invention.

- In Fig. 7 another embodiment is schematically illustrated wherein the system concerned is the GSM-system. Similar to the embodiment described above a call to a mobile station MS will be routed to the visitor location register of the exchange MSC/VLR in which the mobile station MS is registered.
- 10 The exchange, more particularly the MSC/VLR then sends a paging message to the mobile station MS. This page signal (being one of a number of different multiuser signals to which the invention applies) will be distributed (broadcasted) all over a given area, in this particular case a location area LA<sub>i</sub> will send a page
- 15 signal on a control channel DCCH<sub>cd</sub> dedicated for multiuser signals (in this case page signals). In the shown example the cells are three sector cells and the mobile station is digital and therefore there are three digital control channels DCCH per base station controller BSC. In the illustrated GSM-embodiment
- 20 each cell has a base transceiver station BTS which operates on a set of radio channels. A base station controller BSC controls a number of base transceiver stations BTS and a number of BSCs are controlled by one MSC.
- 25 As already referred to the invention relates to all signals which are common or identical for the control channels between a base station BS and an exchange (Base Station Controller BSC and exchange MSC). More generally can be referred to the connection between a base station and the next, hierarchically seen, higher
- 30 station, e.g. Base Station Controller BSC, or Mobile Switching Center MSC etc. One example as already discussed above relates to page signals and another example of such signals are so called short message service signals which are of multiuser type.
- 35 With the invention the load on the control channel (downlink, i.e. from exchange towards mobile station) is reduced and the risk of a bottleneck being produced is also reduced. Also the



load on the receiving processor of the base station is reduced thus also preventing a bottleneck from being produced there.

Also in other aspects the invention is not limited to the shown  
5 embodiments but can be varied in a number of ways. For example it relates to digital as well as analog standards among which AMPS (Advanced mobile phone system), D-AMPS (Digital-AMPS) or ADC, PDC, JDC, GSM, TACS, PCS etc. can be mentioned.

## CLAIMS

1. Arrangement for communication of control data between an  
5 exchange (MSC) and a number of radio base stations (BS;BTS) each  
serving a given area, e.g. a number of cells, in a communication  
system wherein each base station (BS;BTS) is directly or  
indirectly connected to the exchange (MSC) via a connecting  
arrangement comprising a number of control channels,  
10 c h a r a c t e r i z e d in,  
that at least the part of the connecting arrangement (PCM)  
connecting to the base station (BS;BTS) comprises one digital  
and/or one analog control channel ( $ACC_{cd}$ ;  $DCCH_{cd}$ ) dedicated for  
multiuser signals, multiuser signals from the exchange (MSC;BSC)  
15 to a radio base station (BS;BTS) at least on that part of the  
connecting arrangement (PCM) being sent only on the dedicated  
control channel(s) ( $ACC_{cd}$ ;  $DCCH_{cd}$ ) and in that the radio base  
station (BS;BTS) comprises a receiving arrangement which checks  
if an incident signal is a multiuser signal, and if it is a  
20 multiuser signal, it distributes said multiuser signal to at  
least a number of the other control channels of that particular  
base station (BS) and in that further each cell or similar  
comprises a transceiver (TRX) for handling control channel  
functions.
- 25
2. Arrangement according to claim 1,  
c h a r a c t e r i z e d in,  
that the radio base station (BS) comprises at least one cell and  
at least one control channel per cell.
- 30
3. Arrangement according to claim 1 or 2,  
c h a r a c t e r i z e d in,  
that the connecting arrangement comprises one dedicated control  
channel, said dedicated control channel being a digital control  
35 channel ( $DCCH_{cd}$ ).
4. Arrangement according to claim 1 or 2,

c h a r a c t e r i z e d    i n,  
that the connecting arrangement comprises one dedicated control  
channel, said dedicated control channel being an analog control  
channel ( $ACC_{cd}$ ).

5

5. Arrangement according to claim 1 or 2,  
c h a r a c t e r i z e d    i n,  
that it comprises two dedicated control channels of which one is  
an analog control channel ( $ACC_{cd}$ ) and one is a digital control  
10 channel ( $DCCH_{cd}$ ).

6. Arrangement according to anyone of the preceding claims,  
c h a r a c t e r i z e d    i n,  
that the radio base station (BS;BTS) comprises or covers three  
15 cells.

7. Arrangement according to claim 6,  
c h a r a c t e r i z e d    i n,  
that the connecting arrangement (PCM) comprises three analog  
20 and/or three digital control channels of which one digital and/or  
one analog channel is a dedicated control channel ( $ACC_{cd};DCCH_{cd}$ ).

8. Arrangement according to anyone of the preceding claims,  
c h a r a c t e r i z e d    i n,  
25 that the connecting arrangement (PCM) comprises three or six  
control channels.

9. Arrangement according to anyone of the preceding claims,  
c h a r a c t e r i z e d    i n,  
30 that the connecting arrangement comprises a pulse code modulation  
link (PCM).

10. Arrangement according to claim 9,  
c h a r a c t e r i z e d    i n,  
35 that one time slot ( $TS_c$ ) of the PCM-link is used for multiuser  
signals.

11. Arrangement according to anyone of the preceding claims,  
c h a r a c t e r i z e d   i n,  
the multiuser signals comprise page signals and in that page  
signals are sent only on the dedicated control channel  
5 (ACC<sub>cd</sub>; DDCH<sub>cd</sub>).

12. Arrangement according to anyone of the preceding claims,  
c h a r a c t e r i z e d   i n,  
that the receiving arrangement comprises a first intelligent  
10 receiving arrangement (EMRP<sub>cmu</sub>) of the radio base station (BS; BTS)  
or the software of an extended module regional processor  
(EMRP<sub>cmu</sub>).

13. Arrangement according to anyone of the preceding claims,  
15 c h a r a c t e r i z e d   i n,  
that the receiving arrangement (EMRP<sub>cmu</sub>) distributes the multiuser  
signal to control channel processes of the other control channels  
which send the multiuser signal to the respective cell  
transceiver (TRX).

20

14. Arrangement according to anyone of the preceding claims,  
c h a r a c t e r i z e d   i n,  
that the receiving arrangement distributes the multiuser signal  
to all control channels of that particular base station.

25

15. Arrangement according to anyone of claims 12-14,  
c h a r a c t e r i z e d   i n,  
that the first receiving arrangement of the radio base station  
(BS) comprises an operating system.

30

16. Arrangement according to anyone of claims 12-14,  
c h a r a c t e r i z e d   i n,  
that the first receiving arrangement of the radio base station  
(BS) comprises an application part.

35

17. Arrangement according to anyone of the preceding claims,  
c h a r a c t e r i z e d   i n,

that the connecting arrangement (PCM) comprises one digital and/or analog control channel dedicated for multiuser signals from the exchange (MSC) to the base station (BS).

- 5 18. Radio base station (BS;BTS) serving a given area, e.g. comprising a number of cells, in handling radio communication with a number of mobile stations (MS) and further forming an interface to an exchange (MSC;BSC) and comprising means responsible for signalling on a number of control channels of a  
10 connecting arrangement (PCM) with the exchange (MSC;BSC),  
c h a r a c t e r i z e d in,  
that the base station (BS;BTS) further comprises a receiving processor (EMRP<sub>CMU</sub>) for examining the type of transmitted control signals incident on a control channel dedicated for multiuser  
15 signals, one executing processor for each control channel or one executing processor corresponding to a number of or all control channels, at least one transceiver for each cell or similar wherein the receiving processor (EMRP<sub>CMU</sub>) distributes the signal if it is a multiuser signal to the executing processor(s) of at  
20 least a number of the other control channels and in that the executing processor(s) forward the multiuser signal to each a corresponding transceiver.

19. Radio base station according to claim 18,  
25 c h a r a c t e r i z e d in,  
that it comprises a dedicated control channel for analog signals and/or a dedicated control channel for digital signals.

20. Arrangement for communication of multiuser signals between  
30 an exchange (MSC) and a number of radio base transceiver stations (BTS) groupwise connected to base station controllers (BSC) via connecting arrangements (PCM) comprising a number of control channels on the part of a connecting arrangement between the base station controller (BSC) and the base transceiver station (BTS),  
35 c h a r a c t e r i z e d in,  
that the connecting arrangement between base station controller (BSC) and base transceiver station (BTS) of the base station

comprises one digital control channel dedicated for multiuser signals and in that said signals are sent only on this dedicated control channel ( $DCCH_{cd}$ ).

5 21. Arrangement according to claim 20,  
c h a r a c t e r i z e d i n,  
that the multiuser signals such as e.g. page signals are  
distributed to the other control channels connecting the base  
station controller (BSC) with the base transceiver station (BTS)  
10 by a receiving processor of the base station (BTS).

22. Method for reducing the load on control channels in a  
cellular mobile communication system comprising at least one  
exchange (MSC;BSC) and a number of radio base stations (BS;BTS)  
15 each covering a given area, e.g. a number of cells, and a number  
of mobile stations (MS) wherein each exchange (MSC) is connected  
to a number of radio base stations (BS;BTS) via a connecting  
arrangement (PCM) comprising a number of control channels,  
c h a r a c t e r i z e d i n,  
20 - that the exchange (MSC;BSC) sends multiuser signals to the  
radio base stations (BS;BTS) over one digital and/or analog  
control channel dedicated for multiuser signals,  
- a receiving arrangement in the radio base station checks if an  
incident signal is a multiuser signal,  
25 - if it is a multiuser signal, the multiuser signal is  
distributed by processing means ( $EMRP_{cm}$ ) to at least a number of  
the other control channels interconnecting the exchange (MSC;BSC)  
and the radio base station (BS;BTS) and  
- an executing processor of each respective cell sends the  
30 multiuser signal to a transceiver of that respective cell.

23. Method according to claim 22,  
c h a r a c t e r i z e d i n,  
that the multiuser signals are page signals.

35

24. Mobile communication system comprising a number of exchanges  
(MSC;BSC) to each of which a number of radio base stations

(BS;BTS) are connected, each base station covering a given area e.g. comprising a number of cells, with at least one control channel per cell wherein the base station and the exchange are interconnected via a connecting arrangement (PCM) comprising a number of control channels for control data,  
5 characterized in,  
that one digital and/or one analog control channel between an exchange (MSC;BSC) and a radio base station (BS;BTS) is dedicated for multiuser signals, wherein the radio base station (BS;BTS)  
10 comprises a receiving arrangement for checking if an incident signal is a multiuser signal, and if it is a multiuser signal, it distributes the multiuser signal to at least part of the other control channels connecting the base station (BS) with the exchange (MSC), and in that each cell comprises a transceiver for  
15 handling control channel functions.

25. Mobile communication system according to claim 24;  
characterized in,  
that the multiuser signals are page signals.

20

26. Mobile communication system according to claim 24,  
characterized in,  
that the multiuser signals are short message service signals.

25 27. Communication system according to anyone of claims 24-26,  
characterized in,  
that it is the advanced mobile phone system (AMPS) or the digital advanced mobile phone system (D-AMPS).

30 28. Mobile communication system according to anyone of claims 24-27,  
characterized in,  
that it is the GSM-system and in that the dedicated control channels are provided between a base station controller (BSC) and  
35 the base transceiver station (BTS).

FIG. 1

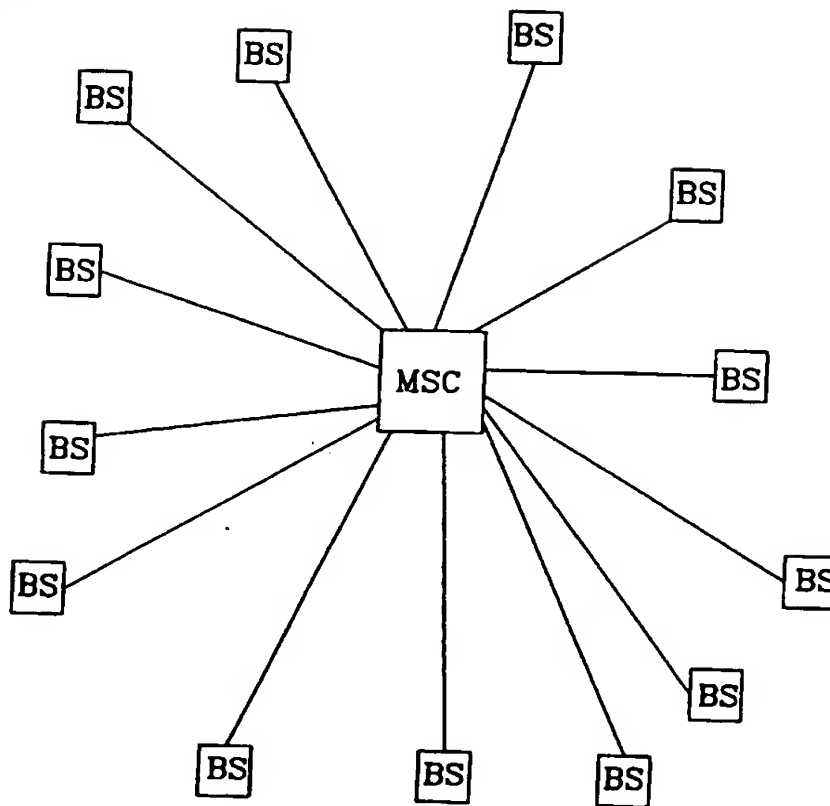
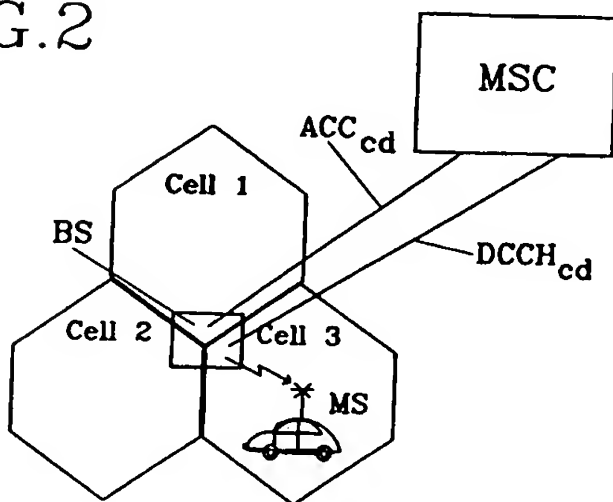


FIG. 2





2:4

FIG. 3a

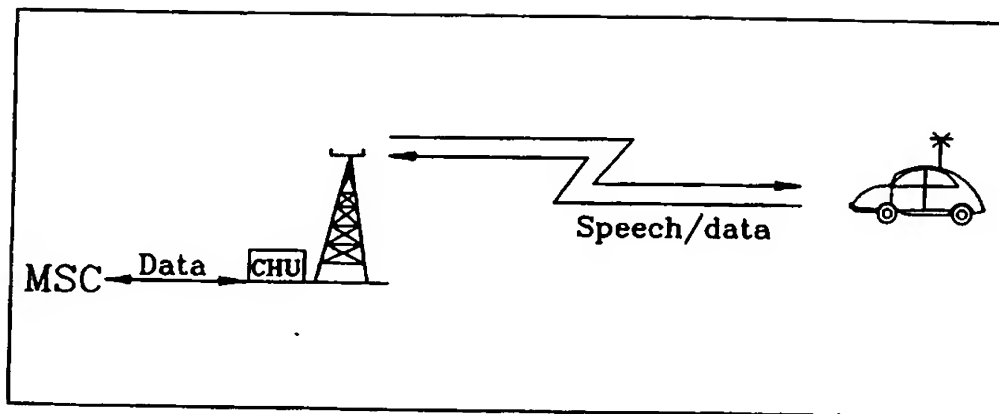


FIG. 3b

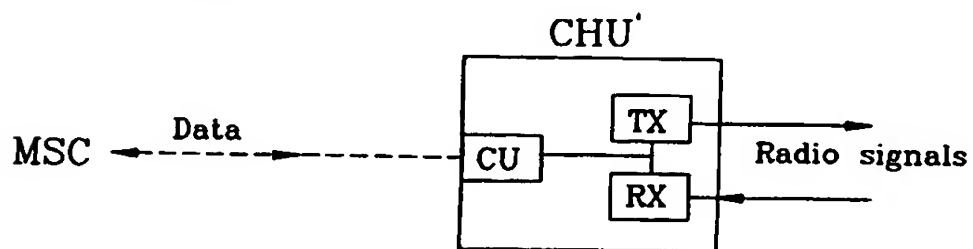


FIG. 4

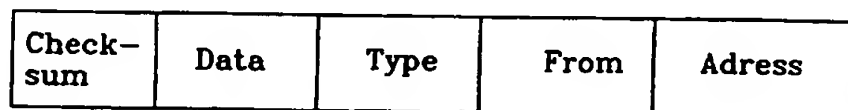


FIG. 5

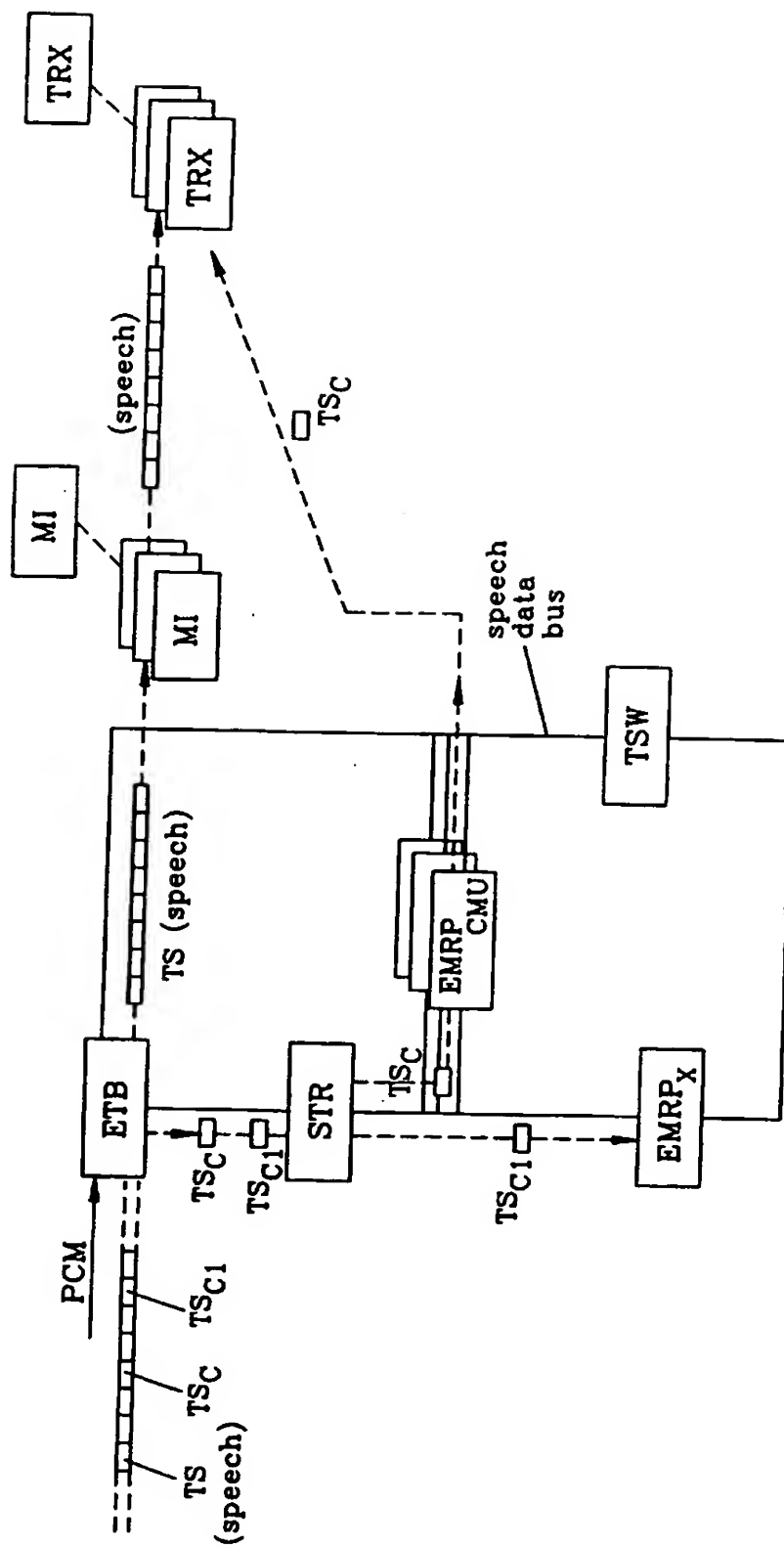


FIG. 6

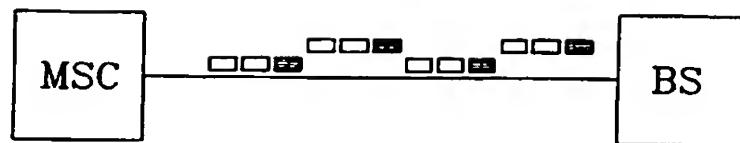
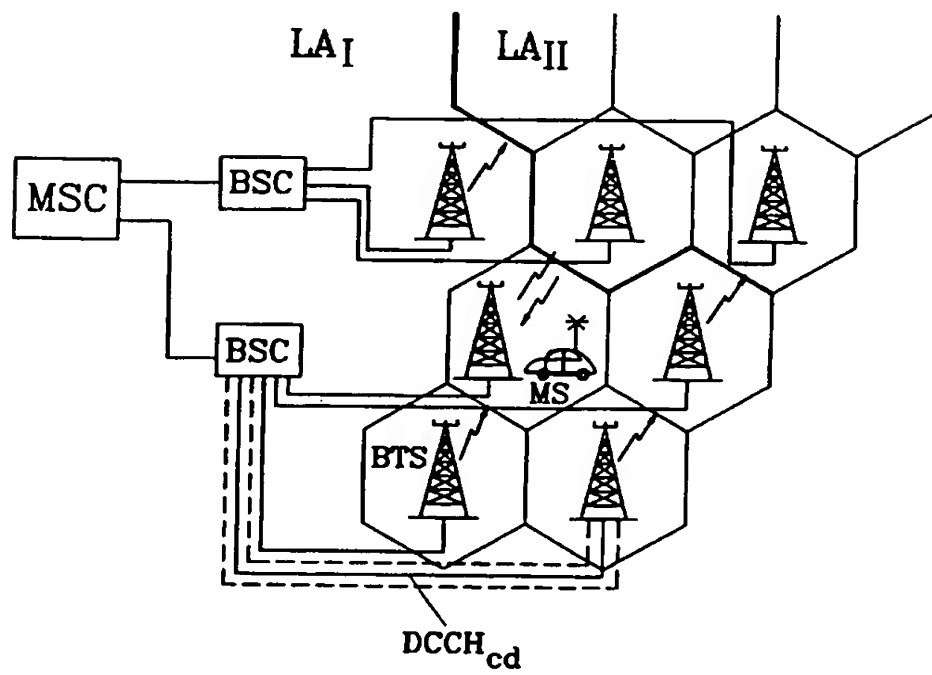


FIG. 7



## INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 96/00047

## A. CLASSIFICATION OF SUBJECT MATTER

IPC6: H04Q 7/38, H04B 7/26

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: H04B, H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 4723266 A (FRED G. PERRY), 2 February 1988 (02.02.88), column 3, line 10 - line 21; column 4, line 23 - line 34; column 5, line 37 - line 47, abstract --	1-13,25-30
Y	US 5317623 A (MASAYUKI SAKAMOTO ET AL), 31 May 1994 (31.05.94), column 4, line 37 - column 5, line 38; column 17, line 27 - line 52; column 18, line 62 - line 68, abstract, see column 19, line 56 - column 20, line 22 --	1-13,25-30
A	EP 0558041 A2 (NEC CORPORATION), 1 Sept 1993 (01.09.93), column 2, line 30 - line 40; column 5, line 37 - line 47, abstract --	1,3-5,7, 11-18

☒ Further documents are listed in the continuation of Box C.☒ See patent family annex.

## \* Special categories of cited documents:

- \*A\* document defining the general state of the art which is not considered to be of particular relevance
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\*X\* document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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\*A\* document member of the same patent family

Date of the actual completion of the international search

Date of mailing of the international search report

6 June 1996

11-06- 1996

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## INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 96/00047

## C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 9416529 A1 (MOTOROLA INC.), 21 July 1994 (21.07.94), see whole document  -----	1,2,3,25

**INTERNATIONAL SEARCH REPORT**  
Information on patent family members

01/04/96

International application No.

PCT/SE 96/00047

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US-A-	5317623	31/05/94	CA-A- 2052466	03/04/92
			EP-A, A, A 0479255	08/04/92
			EP-A- 0700173	06/03/96
			JP-A- 4140935	14/05/92
			JP-B- 7121143	20/12/95
			US-A- 5408514	18/04/95
			JP-A- 4140936	14/05/92
			JP-B- 7121144	20/12/95
			JP-A- 4140937	14/05/92
			JP-A- 4142821	15/05/92
EP-A2-	0558041	01/09/93	JP-A- 6078356	18/03/94
WO-A1-	9416529	21/07/94	NONE	